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Motor vehicle seat

- 5 The invention relates to a motor vehicle seat comprising a seat height adjustment device according to the preamble of claim 1.

10 During an accident, due to the abrupt deceleration, high inertia forces act on the vehicle occupants, the motor vehicle seat and the safety belt system which secures the vehicle occupants. In addition, the abrupt deceleration exerts a force upwards and/or forwards and/or rearwards on a seat height adjustment device,
15 that is often a weak point of the seat structure and there is thus the danger that the seat height adjustment device will become deformed and/or break and consequently the motor vehicle seat, and with it the vehicle occupants, will be shifted upwards and/or
20 forwards and/or rearwards, thus resulting in an increased risk of injury particularly to the head area.

A motor vehicle seat with a seat height adjustment device is known from the German patent application
25 DE 103 16 341.7 dated 10.04.2003, still unpublished at the priority date of this patent application. The seat height adjustment device serves to adjust a first part of the motor vehicle seat relative to a second part of the motor vehicle seat with at least one crash element
30 being arranged between the first and second parts, said crash element preventing or at least hindering a relative movement of the first part with respect to the second part in the event of a collision, with height adjustments of the seat parts being enabled during
35 normal operation. In this case, the first part is, for example, constructed as a seat rail whereas the second part of the motor vehicle seat can be constructed as a top rail that is preferably adjustable in the

longitudinal direction of the vehicle on the vehicle floor. In the event of a collision, the crash element prevents or hinders movement acting on the occupants of the vehicle due to inertia forces and thus contributes
5 to increased vehicle safety and a reduction in the risk of injury.

DE 196 06 605 A1 discloses a vehicle, especially a convertible or coupe with low headroom and with at
10 least one vehicle seat secured to the vehicle floor. The vehicle seat in this case is supported by a floor element that is connected to and locked against the vehicle floor in a manner that permits an almost vertical relative movement. Furthermore, means are
15 provided that in the event of extreme vehicle deceleration, for example during an accident, release the locking and lower the floor element by lowering the vehicle seat through a cut-out in the vehicle floor and lock it in the lowered position. As a result, the
20 entire vehicle seat is actively lowered below the level of the vehicle floor and extended headroom is thus provided in the roof area. A strapped-in seat user can thus not come into contact with structural parts of the roof despite his head being shifted forwards or
25 backwards by the collision.

DE 101 07 695 A1 discloses a motor vehicle seat with a second part that can be moved relative to a first part. A rotary spindle driven by a drive is used to provide
30 the movement of the two parts relative to each other. The spindle has one or more threaded areas and additional end stops in the end area of the thread to limit the movement. Furthermore, a first and a second spindle nut are mounted on the spindle, with a thread
35 of the spindle nuts corresponding to an assigned thread range of the spindle. To enable movement of the particular spindle nut, the first or second spindle nut is at least temporarily mounted in a twist-proof

fashion relative to the spindle. If, moreover, one of the spindle nuts is permanently mounted in a twist-proof fashion, each rotation of the spindle causes a movement of the spindle nut along the spindle. A seat height adjustment device using the spindle and both spindle nuts permits a particularly compact, space-saving structure.

The object of the invention is to provide an improved structure for a motor vehicle seat of the type named in the introduction, that provides increased occupant protection and that especially limits deformation movements of the motor vehicle seat in the event of a collision.

The object is achieved by the object of the independent claim; advantageous embodiments are the object of the dependent claims.

The invention is based on the general concept for a motor vehicle fitted with a height adjustment device that is embodied in such a way as to adjust a first part of the motor vehicle seat in relation to a second part of the motor vehicle seat by arranging at least one crash element between the first and second parts of the motor vehicle seat, that in the event of a collision prevents or at least hinders movement of the first part relative to the second part.

According to the invention, the crash element is embodied as a piston-cylinder unit for this purpose, with the piston being connected to the first part and the cylinder to the second part of the motor vehicle seat or vice versa. To prevent or at least hinder relative movement of the first part relative to the second part of the motor vehicle seat in the event of a collision, a cylinder wall of the crash element is provided with an opening through which a toothed

blocking element of a blocking device can be engaged in a blocking manner with a toothing formed on the piston, at least in the event of a collision.

5 The solution according to the invention therefore prevents a dangerous seat position during a collision and thus keeps head, breast, pelvis and knee values of the vehicle occupants within a limit range whereby the risk of injuries can be reduced. At the same time the
10 crash element according to the invention holds the motor vehicle seat, and therefore the person seated and strapped to it, in a favourable position relative to safety devices, such as an airbag, and vehicle safety, especially protection of the occupants, can accordingly
15 be increased by the invention. Furthermore, the invention guarantees the fixing of both parts of the motor vehicle seat relative to each other during a vehicle collision and thus does away with the need for expensive and costly seat reinforcing, an alternative
20 that would fulfil the same function.

According to an advantageous form of embodiment of the solution in accordance with the invention, the mounting point of the cylinder or of the piston on the first
25 part of the motor vehicle seat is at the same time a mounting point for a belt buckle. This has the advantage that the force that acts during a vehicle collision on a vehicle occupant, and thus on the safety belt or belt buckle, is directed into the crash element
30 at the same time. The line of force in this case runs almost parallel to the tension/compression direction of the piston and is therefore particularly favourable, without lateral forces being introduced in the crash element. By means of an articulated mounting of the
35 crash element on both the first part of the seat and on the second part of the seat, this effect can be additionally reinforced because in this case, similar

to a pendulum support, no moments can be introduced into the crash element.

5 A collision sensor or a pre-collision sensor can expediently be provided that in the event of a collision or a pre-collision moves the blocking element to its blocking position. Collision sensors of this kind detect an accident directly when the collision occurs or, if designed as pre-collision sensors,
10 immediately before the actual vehicle collision. This offers the possibility of activating the blocking device in good time, which means that vehicle safety and particularly the protection of the occupants can be increased.

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According to a preferred development of the invention, the actuation of the blocking element, and thus the blocking of the blocking device, takes place mechanically, pyrotechnically, electrically or
20 electromagnetically. This list shows the wide design possibilities of the blocking element actuation associated with the invention and thus clearly shows the practical applicability afforded by the high degree of flexibility.

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According to a further embodiment of the invention, at least one locking element is provided that when triggered fixes the blocking element in its blocking position. The locking element thus prevents
30 disengagement of the blocking element and ensures permanent blocking of the crash element. By means of the locking element, that for example can be designed as a spring-loaded locking pin, unintentional movement of the blocking element to its non-blocking position is
35 prevented.

Further important features and advantages of the invention are given in the subclaims, in the drawing and in the associated description of the drawing.

- 5 It is obvious that the features given here and those still to be given in the following can be applied not only in the given combinations but also in other combinations or on their own, without departing from the scope of this invention.

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A preferred exemplary embodiment of the invention is shown in the drawing and is described in more detail in the following.

- 15 The single figure 1 shows a side view of a crash element according to the invention.

Figure 1 shows a first part 2 of a motor vehicle seat 1 and a second part 3 of the motor vehicle seat 1 connected to it by a crash element 4. The first part 2 of the motor vehicle seat 1 can moreover, for example, be designed as the frame of a seat surface, while the second part 3 of the motor vehicle seat 1, for example, forms part of a guide at the floor end. The height of the motor vehicle seat 1 can be adjusted by means of a seat height adjustment device (not illustrated) in that the first part 2 of the motor vehicle seat 1 is moved relative to the second part 3 of the motor vehicle seat 1. The crash element 4, that in the event of a collision prevents or at least hinders movement of the first part 2 relative to the second part 3, is arranged between the first part 2 and the second part 3 of the motor vehicle seat 1.

- 35 The crash element 4 is designed as a piston-cylinder unit as shown in figure 1, with the piston 5 thereof being connected to the first part 2 of the motor vehicle seat 1 and the cylinder 6 thereof to the second

part 3 of the motor vehicle seat 1. The piston 5 of the crash element 4 is, as shown in figure 1, connected to the first part 2 of the motor vehicle seat 1 in such a way that during the adjustment of the seat height the piston 5 is forcibly moved in its tension/compression direction 15. The movement of the crash element 4 in its tension/compression direction 15 during the adjustment of the seat height takes place almost without resistance.

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It is generally conceivable for the piston-cylinder unit to have a piston 5 or cylinder 6 that is essentially of round cross-section, with other cross-section shapes, for example, angular, especially of rectangular cross-section, being possible. The piston-cylinder unit is accordingly not necessarily restricted to the conventional piston and cylinder of round cross-section but instead serves merely as a description of a telescopic crash element 4. The piston-cylinder unit according to the invention furthermore provides a reliable guidance in its tension/compression direction 15, which means that additional guide elements, such as for example would be necessary in just the tensile direction of stable crash elements, can be omitted.

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An opening 8 is provided in a wall 7 of the cylinder 6 through which, at least in the event of a collision, a toothed blocking element 9 of a blocking device 10 can be engaged in a blocking manner with a toothing 11 formed on the piston 5 by adjusting in an adjustment direction 16. The piston 5 is then supported on the cylinder 6 by the blocking element 9. Due to the engagement in a blocking manner, movement of the first part 2 of the motor vehicle seat 1 relative to the second part 3 of the motor vehicle seat 1 is prevented or at least hindered so that a dangerous movement of the seat during a crash is prevented and an associated high risk of injury can be thus be reduced.

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As shown in figure 1, a mounting point 12 is embodied or formed on the cylinder 6, with which the cylinder 6 is rotatably attached either to the first part 2 or the second part 3, in this case the second part 3, of the motor vehicle seat 1. This mounting of the cylinder 6 on a part 2, 3 of the motor vehicle seat 1 can moreover be by means of suitable mounting elements (not illustrated) such as screw-type elements. The rotatable mounting of the crash element 4 at both ends to both parts 2 and 3 of the motor vehicle seat 1 ensures the mounting of the crash element 4 as a pendulum support, thus preventing moments being introduced into the crash element 4. This also means that a force line acting on the crash element 4 runs essentially parallel to the tension/compression direction 15.

Advantageously, the mounting point 12 of the piston 5 or of the cylinder 6, in this case the piston 5, on the first part 2 of the motor vehicle seat 1 is at the same time a mounting point 12' for a belt buckle 13. Because of this particularly advantageous arrangement, an improved force introduction through the belt buckle 13 directly into the crash element 4 is achieved without the forces having to be diverted beforehand and further unfavourable stresses thus produced. At the same time this means that one and the same mounting point 12' is used both for connecting the belt buckle 13 to the first part 2 of the motor vehicle seat 1 and also for connecting the piston 5 to the first part 2 of the motor vehicle seat 1, thus reducing production times or production costs.

According to figure 1, the blocking device 10 is arranged on an outer side of the cylinder 6. It is also conceivable in this case for the blocking device 10 to be formed on one side of the cylinder 6 or for two

blocking devices 10 to be arranged opposite each other on the outside.

5 Movement of the blocking element 9 to its blocking position can moreover take place mechanically, e.g. by means of a self-locking friction clutch; pyrotechnically, for example by means of a firing capsule; electrically, for example by means of an electrical servo drive; or electromagnetically, for example by means of electromagnets. To achieve the earliest possible blocking movement of the blocking element 9 along its blocking direction 16 and thus achieve blocking of the blocking device 10, a collision sensor (not illustrated) can additionally be provided
10 that in the event of a collision moves the blocking element 9 to its blocking position. Alternatively, a pre-collision sensor can also be provided that moves the blocking element 9 to its blocking position immediately before a collision.

20 Furthermore, it is also conceivable for the blocking element 9 to be permanently in its blocking position and only moved to its non-blocking position counter to the blocking direction 16 by an adjustment of the seat height. This has the advantage that the blocking
25 element 9 and thus the crash element 4 always prevents or hinders a movement of the first part 2 relative to the second part 3 of the motor vehicle seat 1 and permits it only at a desired seat height setting. This allows collision sensors or pre-collision sensors to be omitted, whereby additional cost advantages can be realized. At the same time, this embodiment offers increased vehicle safety because failure in the event of a collision can be prevented.

35 Generally, at least one locking element 14 can be provided that when triggered fixes the blocking element 9 in its blocking position. A locking element 14 of

this kind can, for example, be a spring-loaded locking pin that after a blocking movement of the blocking element 9 to its blocking position 16 moves in between a wall of the blocking device 10 and a blocking element 9 and thus prevents movement of the blocking element 9 counter to the blocking direction 16. A locking element of this kind 14 is moreover particularly advantageous if in the event of a collision the piston 5 transmits, due to its force acting in a tension direction 15, a resetting force through the tothing 11 that acts on the blocking element 9. Such transmission of a resetting force to the blocking element 9 can, alternatively, be prevented by a special embodiment of the tothing 11, for example as saw-tooth tothing. With an embodiment as a saw-toothed tothing, the piston 5 does not transmit forces transversely to it in the blocking direction 16 to the blocking element 9 due to a force acting in the tension direction 16.

It is also conceivable that the crash element 4 enables a movement in the compression direction but prevents movement in the tension direction 15. Furthermore, an actuating device could be provided that in the event of a collision or pre-collision, including with the crash element 4 activated, effects a movement of the motor vehicle seat 1 to a lowered position and thus creates increased headroom.

To summarize, the essential features of the solution in accordance with the invention can be characterized as follows.

The invention provides a crash element 4 that is arranged between a first part 2 and a second part 3 of a motor vehicle seat and that in the event of a collision prevents or at least hinders relative movement of the two parts 2 and 3. The crash element 4 is in this case designed as a piston-cylinder unit with

the piston 5 being connected to the first part 2, and the cylinder 6 with the second part 3, of the motor vehicle seat 1. To block the crash element 4 at least in the event of a collision, an opening 8 is provided in a cylinder wall 7, through which a toothed blocking element 9 of a blocking device 10 can be engaged in a blocking manner with a tothing 11 formed on the piston 5, at least in the event of a collision.

- 10 Due to the solution according to the invention, vehicle occupants strapped to the motor vehicle seat 1 are held in a favourable position in the event of a collision and the risk of injury thus reduced. At the same time, there is no need for an expensive and costly seat
- 15 reinforcement, that would fulfil the same function with respect to the blocking movement in the event of a collision, so that cost advantages can be realized.